

原 著

A research on students knowledge, awareness and interest about environmental issues; a case study at a high school in Japan.

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Abstract

Education for Sustainable Development (ESD)-Environmental Education, has been a major concern at most UN summits. The 2002 Johannesburg Summit broadened the vision and re-affirmed the objective of the Millennium development Goals (MDS) and proclaimed the Decade of Education for Sustainable Development for the period 2005 – 2014. This emphasized that education, is critical for promoting sustainable development and improving capacity of the people to address environment and development issues. This paper seeks to report, a finding on the level of student awareness and interests in environmental issues at a High School in Japan (*a Super Science High School*). A curricula unit was developed in the area of environmental education on soil. An actual chemistry class has been conducted in English. Pre & post lesson questionnaires were administered to the students. The result of the analysis indicates that, students are aware of environmental issues but need to be exposed to these issues in the form of activity-based classroom lessons. This we believe, will enable the students appreciate the fact that ESD is a life-wide and lifelong endeavor which challenges individuals, institutions and societies to view tomorrow as a day that belongs to all of us. This we presume is the main challenge of the MDS.

Key words: Environmental Education, Awareness, Students' interest, Curriculum, Soil.

I . Introduction

In recent years, many words and phrases have been introduced to meet the needs of the development of science and technology as well as modern society. For better understanding and utility, scientific words have been established and ideal and concrete concepts have also been formulated. Moreover, we can recognize that the environmental issues close to us are ultimately linked with global environmental problems. We must cultivate the desire, attitude, and motivating power to solving these problems with the concept of “Think Globally, Act Locally”, a typical popular phrase used in Education for Sustainable Development which mainly focuses on Environmental Education. It is an understandable phrase that urges everyone to contribute every little thing to the community as well as the global world. In addition, the current materials, theories and methods used for the field of environmental education were contributed by many researchers all over the world.

Soil plays a vital role in present day agriculture which is able to provide food, shelter and clothing for the world's rapidly increasing population. Growing crops for food has long been a major human activity. The rapidly increasing population means providing enough food to meet the demand without destroying

our environment which is one of the biggest challenges of the Millennium Development Goals. (1). Soil is the medium for the production of most food, upon which most living must depend. Therefore, soil is one of the key components of environmental chemical cycle. But indiscriminate human activities has led to serious environmental problems such as: ozone layer depletion, global warming, environmental degradation, pollution of air, water and land, deforestation which is as a result of the removal of the vegetation resulting to a large scale-erosion; loss of biodiversity; diversion of watercourses and siltation in rivers; acid mine drainage, surface and underground water contamination due to acidity and dissolved metal content which combined with waste dumps, solid waste and wind-blown dust, also results in direct health hazards to large populations. The advent surge of large scale use of sulfur, nitrogen and hydrofluorocarbons compounds has resulted in the emission of large amount of SO and NO_x gases leading to acid rains in recent times. Scientists have therefore, devise many means of combating the negative effects to make life comfortable for mankind and the generations to come (1, 2). It is based on the above mentioned effects of human activities that, there is an urgent need for a link between the environment, education and human beings with soil serving as the main bridging media. This, we think should start at the basic level of the educational ladder for the pupils to be exposed to some of these challenges and at this level, begin to think of how best they can also contribute to solving these problems.

II . Background of the Study

There can be few but more pressing and critical goals for the future of mankind than to ensure steady improvement in the quality of life for present and future generations, in a way that respects our common heritage – the planet we live on. As people, we seek positive change for ourselves, our children and grandchildren; we must do it in ways that respect the right of all to do so. To do this we must learn constantly – about ourselves, our potential, our limitations, our relationships, our society, our environment, and our world. Education for sustainable development is a life-wide and lifelong endeavor which challenges individuals, institutions and societies to view tomorrow as a day that belongs to all of us, or it will not belong to anyone. [UN, Decade for Education for Sustainable Development, Johannesburg, (2002)].

The United Nations Conference on the Human Environment in Stockholm in 1972, helped to focus attention on environmental concerns and in the years following the conference, the global community acknowledged that more exploration was needed for the inter-relationships between the environment and socio-economic issues of poverty and underdevelopment. Thus, the concept of sustainable development emerged in the 1980s in response to a growing realization of the need to balance economic and social progress with concern for the environment and the stewardship of natural resources. The concept of Education for Sustainable Development (EDS) gained worldwide momentum with the publication of the Common Future by the World Commission on Environment and Development in 1987, which defined sustainable development in its publication as; “*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*” This definition considers that while development may be essential to satisfy current human needs and improve quality of life, it should occur in such a way that the capacity of the natural environment to meet present and future needs is not compromised. The United Nations Environmental Programme and the World Wide Fund for Nature (WWFN) in 1991, document also defined sustainable development as “*improving the quality of human life*

while living within the carrying capacity of the supporting ecosystems." The UN Conference on Environment and Development in 1992, the Earth Summit, gave high priority in its Agenda 21 to the role of education in pursuing the kind of development that would respect and nurture the natural environment. It focused on the process of orienting and re-orienting education in order to foster values and attitudes of respect for the environment and envisaged ways and means of doing so. The human and social aspects of sustainable development which meant solidarity, equity, partnership and cooperation were, as crucial as scientific approaches to environmental protection. Besides, re-affirming the educational objectives of the Millennium Development Goals and the Education for All, the Dakar Framework for Action. This summit proposed the decade of education for sustainable development as a way of signaling that education and learning lie at the heart of approaches to sustainable development. Chapter 36 of Agenda 21 emphasized that education is critical for promoting sustainable development and improving capacity of the people to addressing environmental and developmental issues. Ever since, EDS has been a common concern in all UN conferences and there has been a common consensus that education is the driving force for the change needed. The 2002 Johannesburg Summit broadened the vision and re-affirmed this objective of the Millennium Development Goals and proclaimed the Decade of Education for Sustainable Development for the period 2005 – 2014 for which Japan, and all other participating countries are part of. This has two main objectives;

1. Deepening the *understanding* of each and every one of us about the relationship between human beings and the environment and
2. Raising the *awareness* about the values of rich nature and pleasant environments, that will lead us, live lives with consideration to the environment and engaged in responsible actions.

This is to provide every person with the opportunity to acquire knowledge, values, attitudes and skills needed to protect and improve the environment and to create new patterns of behavior of individuals, groups and society as a whole towards the environment (2, 3) by adopting the tools of saving the environment known as the 4R's: Reduction, Recovery, Reuse and Recycling. Schooling, at all levels, is a critical component of the strategy towards environmental learning that will lead to new patterns of behavior and dispositions towards the environment. For this reason, all the major policy documents in the participating countries have been streamlined with environmental education as a key component of all the proposals for educational renewal and curriculum development. But in spite of all efforts and commitments made by the United Nations and other bodies to enforce awareness creation and deepening of knowledge of all involved, little is being realized in the classrooms. It on the above mentioned concerns that we find it necessary to research on the above topic.

III. Purpose of Study

The research seeks to investigate on students' knowledge and the level of awareness being created among students in the area of Education for Sustainable Development (Environmental Education) in schools, a case study at Johnan High School – Tokushima prefecture in Japan *a supper science high school*, under natural science, compare it to that of the Ghanaian situation and develop a curriculum unit for an

integrated studies in the area of Environmental Education on Soil for Ghana which can also apply to any other developing or developed country.

IV. Brief outline of Japanese Education System

The modern school system of Japan began from the promulgation of the school system in 1872. The fundamental law of education and the school education law were enacted in 1947 after the Second World War, and the 6-3-3-4 year system was established aiming at realizing the principles of equal opportunity for education. Upper secondary schools were established in 1948, offering full time and part time courses and in 1961 correspondence courses were added. The new system of university began in 1949. The junior college system was also established in 1964 following an enactment of the school law in that year. The disabled are properly educated at the school for the blind, the deaf and schools for other disabled, or in special classes at elementary and lower secondary schools. In addition, there are kindergartens for pre-school children, and specialized training colleges and other miscellaneous vocational schools which are offering technical courses for various practical purposes. In pursuant to the amendment to the school education law in June, 1998, the six-year secondary school education has been established to enable consistent education covering teachings at all levels from the year 1999.

V. The State of Environmental Education in Japan

To show its commitment to peace, stability and sustainable development around the globe as stated in agenda 21, the government of Japan was among the first instrumental in signing the Kyoto protocol in 1992 which came into full effect on the 16th of February 2005. This was seen as a "first step" toward reductions in greenhouse-gas production, and in accordance with Chapter 36 of Agenda 21 of the UN convention, Education for Sustainable Development (Environmental Education) was instituted at primary, junior high and senior high levels in all Japanese schools across the country since 2002. In Japan, the content of Education for Sustainable Development includes poverty reduction, human rights, international understandings, earth environmental observation and science technology by the introduction of measures by MEXT which are the core issues on education for sustainable development. These measures include;

- 1 The provision of a guide book on environmental education issued by the MEXT in 1991 entitled "*Guidance for environmental education in Japanese schools*" and
- 2 An enactment of a law for Enhancing Motivation on Environmental Conservation and Promotion of Environmental Education in 2003.

This law provides fundamental ideas of environmental conservation and education, motivation for improvement of environmental conservation and education, in making responsibilities clear by nations, private sector, national and local governments. This law draws up basic policy and other necessary items for improving, motivations of environmental conservation and education. The law also states measures concerning improvement of environmental education in schools which should be taken by national government and local government i.e. enrichment of learning by experiences, improvement of teacher quality. Following the enactment of the law, MEXT became the main body which decides on the courses of

study in order to establish a fixed level of education nationwide and guarantee equal opportunity for learning in Japan's school education. The period of "Integrated studies" has been introduced in the new course of study which was implemented in succession in elementary, junior high and senior high schools from 2002 to deepen intersecting-subject learning. The environmental-related content in subject such as social studies and science has also been improved, problem like acid rain and global warming are taken up in connection with issues like global environment, resources, and energy; problem-solving learning is carried out by students as well. In the period of integrated study experimental learning such as nature experience activities and research learning about the regional environment close to us is being carried out. MEXT has also paved the way for the establishment of Super Science High Schools/ Eco Schools where students in these schools are exposed to facilities with consideration given to the environment for the sake of both lowering the burden on the environment and for environmental education and learning with the following functional elements;

- 1 The facilities are design to alleviate the burden on the environment.
- 2 The schools education contributes to learning that can be applied to environmental education, as well and
- 3 In operational terms, the school effectively applies and effectively uses natural energy.

All of which are aimed at lowering energy and resource consumption by applying sunlight and wind power as well as making use of rain water and recycled water. The most important is the development of teaching materials for the promoting of environmental education in succession from the elementary level to the senior high level and the setting up of projects to advance rich experiential activities and Green Plan for Advancement of Environmental Education. Typical examples are the "Environmental Education Practice Model Project" which designates municipalities to grapple with conducting environmental education in unison with the schools, homes, and immediate surroundings and the "Globe Projects," a program advocated by the United States of America. Finally, to coordinate the activities of implementing environmental education in schools, universities, museums, local communities and local governments, the idea of Regional Centers of Excellence on Education for Sustainable Development had been implemented which is a prerequisite requirement for Education for Sustainable Development by the year 2015. (3, 4)

A research was conducted on the topic "*A comparative study on energy education at the basic level between Ghana and Japan*" A case study at Tsunemine elementary school, Tokushima prefecture in Japan. This school was designated as SSH/ Eco Schools. The findings were (1) in Japan, the main source of energy is nuclear whereas in Ghana it is hydro-electricity, (2) all the energy topics in Japan are integrated with other subjects whereas in Ghana they are mostly taught under natural science, (3) some schools in Japan are sponsored by private companies in the energy sector as a project, an example is Tsunemine elementary school. In these schools energy lessons are started at grades 1 and the lessons are more practically oriented (6). The above educational policies, we believe, has put Japan in a better position to fully tackle issues relating to environmental education and we believe other developing and developed countries can take a cue from this.

VI. The Research Method

To find out to what extent students at Johnan (Grade 11) are aware about environmental issues, a

survey was conducted to bring to light their level of knowledge, awareness and interest. Based on other research carried out that aimed at issues associated with the environmental education in these countries a self completion questionnaire was developed to provide not only quantitative data but also, more importantly, qualitative statements from which to derive various constructs.

VII. Questionnaire and Population

The questionnaire consisted of 11 items, which students were to respond to and were distributed to grade eleven (11) students of Johnan High School, Tokushima Japan; a super science school, in all about 40 pre & post lesson questionnaires were administered to the same particular class. See appendix for a sample of questionnaire.

VIII. Results and Discussion

1. Knowledge and Awareness

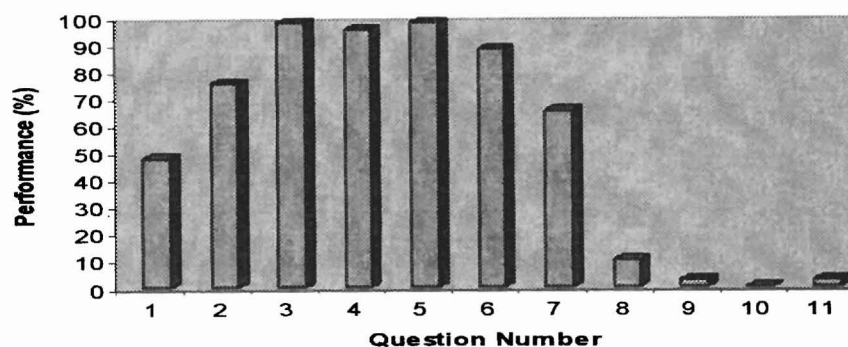


Fig. 1 Students' performance in the pre-test

Questions asked in the questionnaire include the following;

1. Please, write down what is 'Environment' according to your own thought
2. Have you heard of any 'Environment issues' before?
3. Have you heard of the word 'acid rain' before?
4. Which of the following gases are likely to cause acid rain?
5. Have you heard of the word 'green house effect' before?
6. Which of the following can cause 'green house' effect?
7. What is ozone layer?
8. Which of the horizons contains the most Humus?
9. Mention two main substances that pollute the soil.
10. In your own words what is drinking water contamination?
11. Write down two ways by which our Environment can be managed.

From figure 1, the general trend of students' performance in questions 1, 2, 3, 4, 5, 6 and 7 were quite impressive but again it was relatively low. This could be attributed to the fact that, all questions were asked in English and by that; the Japanese students could not express themselves sufficiently. Also, these questions are mostly related to whether the students are aware of environmental issues. Their performance in these areas was indicative that they are aware of environmental issues.

The general performance by students in questions 8, 9, 10 and 11 was different as the performance of students was extremely very poor. These questions are more on soil, water quality, environmental pollution and management. This clearly showed that even though students are aware of environmental issues, they had little knowledge on topics such as soil, water quality and environmental management.

2. Students' Interest

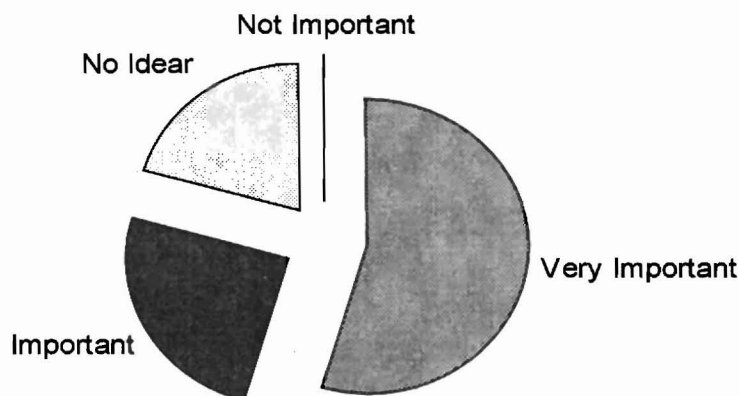


Fig. 2 Students' interest in the environment and environmental issues

Students were also asked to indicate their level of importance and interest in environmental issues. From figure 2, it was clear that most of the students are very interested in environmental issues. About 60 % of the respondents indicated the environment in very important. 27.5 % indicated it is important and 22.5 % said they have no idea about the environment. This is an indication of the students' prepared to study about the environment and environmental issues.

Based on the above observations, it is clear that students need more information and knowledge on topics relating to soil, water quality, environmental pollution and management. A curricula unit on soil has been developed. The unit is made up of four main sections each of which comprises child centered, activity-based lessons with sample experimental procedures applicable to the basic, secondary, and collegiate levels of all educational establishments. These activities have been tried as an actual classroom experiment at Johnan High School, a *Super Science High* (SSH) school in Tokushima Prefecture, Japan. One of the authors (Agbeko) conducted some chemistry lessons in English on soil. This school has been assigned as a pilot school for Mathematics and Science school projects by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). The main sections are shown in table 1.

Table 1 The main sections and teaching schedule at Johnan High School

Sections	Topic/Activity	Day & Time
I (Physical aspect of soil)	Acid Rain: Origin and effects to the Environment Lets examine some properties of soil; adsorption, ion-exchange, neutralization and water retention	Thursday July 8 th 2004 1:25 – 3:30 pm
	Determination of Soil Buffer and purification Capacities	Thursday July 22 nd 2004 1:25 – 3:30 pm
II (Inorganic aspect of soil)	Measurement of elements in the soil (Al^{3+} & Fe^{3+}) Using 8-Quinolinol and 1,10 – phenanthroline as complexing ligands	Thursday October 7 th 2004 1:25 – 3:30 pm
III (Organic aspect of soil)	Soil & Humic substances: Organic matter in the soil, Properties of Humic Acids	Thursday Nov. 11 th 2004 1:25 – 3:30 pm
	Extraction of humic acid from humus in black soil	Wednesday, Dec. 1 st 2004 1:25 – 2:15 pm
IV (Biological aspect of soil)	Lets examine micro-organisms in the soil	Thursday January 7 th 2005 1:25 – 3:30 pm

Table 1 shows the complete unit section on soil and activities at Johnan High School. The curriculum unit consists of four main comprehensive sections on soil. Section I mainly dwells on environmental issues; the relationship between acid rain and soil and examined the physical properties of soil i.e. soil composition and structure, qualitative and quantitative analysis of soil and more specifically, the relationship between rocks, soil and clay minerals, the structure and composition of clay minerals and the properties of clay minerals such as adsorption, ion-exchange, neutralization, water retention, soil buffer and purification capacities. Section II is on inorganic aspect of soil; the quantitative and qualitative analysis of elements in the soil, the relationship between elements and the soil particles. Section III considered the organic aspect of soil by looking at the organic matter in the soil, the relationship between humic acid, organic matter and black soil thus extraction of humic acid from black soil and section IV finally considered the biological aspect of soil by exposing students to the activities of micro-organisms in the soil. This, we believe will dramatically improvement the students understanding of environmental issues in general and on soil in particular.

This unit has been tried on the same students at Johnan High School, Japan and their general performances are as follows.

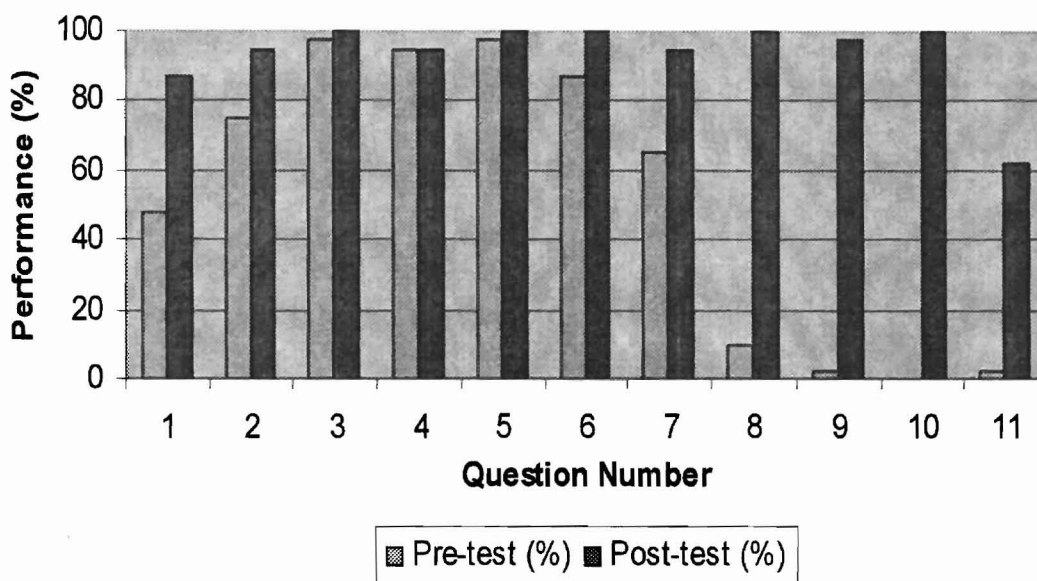


Fig. 3 Pre & posttest analysis at Johnan High School

It can be observed from figure 2 that, student performance at Johnan High School has improved tremendously, especially in questions 6 – 11 which included questions like; Which of the following can cause 'green house' effect?. What is ozone layer? Which of the horizons contains the most Humus? Mention two main substances that pollute the soil. In your own words what is drinking water contamination? And Write down two ways by which our Environment can be managed to prevent it from degradation. These questions are basically on soil, water quality, environmental pollution and management. About students' impression on the lesson on soil, the following observations were made by the students;

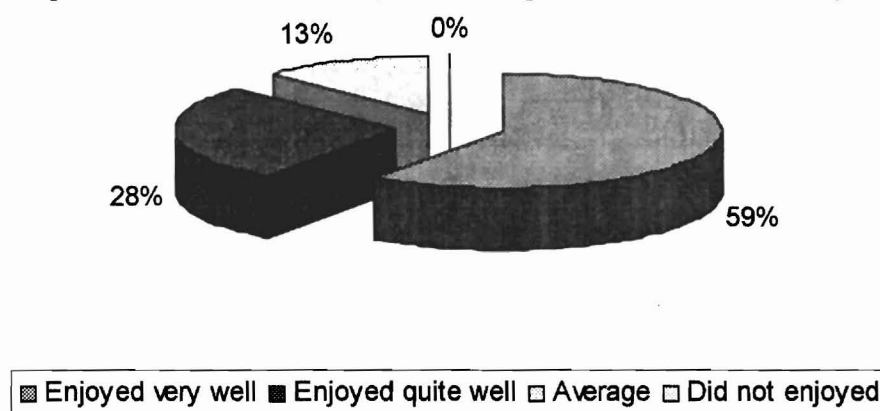


Fig. 4 Students' impression about lesson on soil and environment

From figure 4, the students' responses show that, the lesson was successful and fruitful. Students had the experience of being exposed to soil and the environment. They all evaluated the activities on soil as very interesting and investigative. About 59% of the students said they enjoyed the lesson very well, 28% they enjoyed quite well and 13% said they enjoyed averagely with none of the students remarking that I did not enjoyed at all.

Students' were also provided with a post-lesson assessment questionnaire with the following question;

I. What did you study in each section?

1. Physical properties and functions of soil (Soil Buffer capacity)
2. Inorganic aspect of soil (Elements in the soil)
3. Organic aspect of soil (properties of humic acid)
4. Biological aspect (microorganisms in the soil)

II. Which experiment was most interesting?

III. General impression about lessons in English

3. Students' responses

On physical properties of soil, students were able to demonstrate that, soil takes off dirt from underground water. Black soil is very different from ordinary sand. That soil has buffer capacity, adsorption capacity, has high water retention capacity, ability to neutralize acid and alkaline. Soil has the tendency to remove most hazards from river water. Soil purifies underground water. Soil is very important to life in general and humans in particular. Properties of soil depends on it location and mineral content. The soil has many spaces which contain air and microbes. Soil is closely related to our lives. Soil has the ability to weaken acid and alkaline in river water.

About elements in the soil, student has this to say: "soil has many elements including diamond and gold. Soil contains a lot of aluminum iron, whose concentration and amount can be measured. Higher absorbance shows higher concentration of element in the solution. Soil contains metal and the amount of mineral in a particular soil differs from that in another soil". On the organic aspect of soil; student documented that, there is a lot of humus in the soil formed from dead organic matter. Humus contains humic acid which can be extracted. Humic acid has adsorption capacity, has high water retention capacity, ability to neutralize acid and alkaline, has the ability to bind hazardous metals. Humic acid can reduce iron(III) to iron(II), cleans and purifies ground water. Humic acid is great and very useful to plant and animals. About the activities on microorganisms in the soil, students indicated that, microbes in the soil decompose starch and organic matter. Microbes produce more carbon dioxide in the soil which is used by plants. That, microbes can act on many kinds of matter. As to which experiment was most interesting, student has the following to say, about 30 % of the students showed interest in activities on microbes in the soil. 35 % said they enjoyed the activities on physical properties of soil, 20 % also said they were interested in the activities on elements in the soil and the remaining 15 % said they enjoyed the activities on microorganisms in the soil. In all, it can be deduced that all the students derived some satisfaction from the activities and lesson on soil and environment.

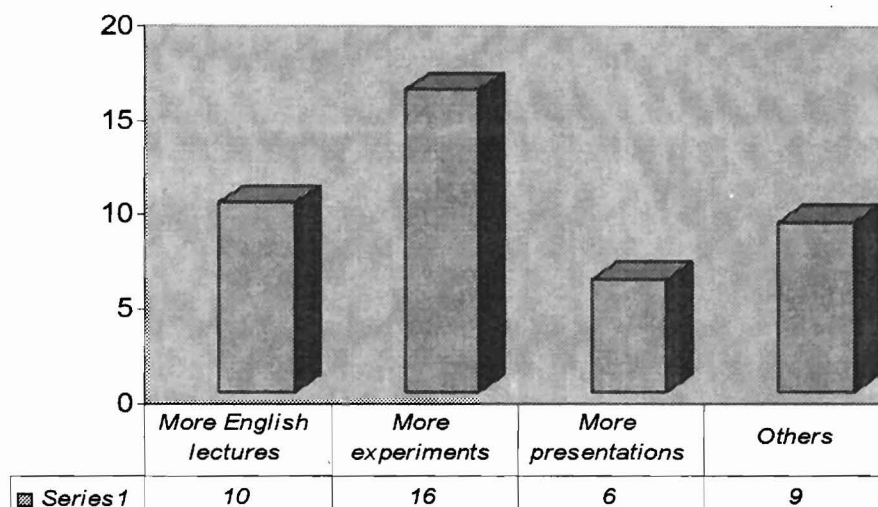


Fig. 5. Students' impression about lesson in English

From figure 5, it is obvious that about 24.4 % of the students wanted more lectures in English. About 40 % of the students wanted more activities on soil and environment. 15 % of the total students want to be exposed to more presentation in English and 22.5 % were undecided. In general most of the student indicated English was very difficult initially but with time they became used to the lecturer. More so, the instructor was very nice and has great sense of humor for Japanese students.

4. Conclusion

Finally, these recommendations are made for enhancing the conceptual and practical capabilities of the students about Education for Sustainable Development. It is imperative that students are made aware of the aspect of ESD-environmental Education. Concepts like acid rain and global warming, ozone layer depletion, green house effect are taken up in connection with issues like global environment, resources, and energy; problem-solving in relation to soil and agriculture, should be included in all school curriculum at the basic, senior high and teacher training institutions. Moreover, in accordance with chapter 36 of agenda 21 which proposed the decade of education for sustainable development as a way of signaling that education and learning lie at the heart of approaches to sustainable development, which emphasized that education is critical for promoting sustainable development and improving capacity of the people to address environment and development issues. There is a need for a link between the environment, education and human beings with soil serving as the main bridging media. The researchers are confident that this method when exposed to students of high school and/or collegiate levels would make an impact in a way that will bring them closer to some of the practical solutions to the challenges of the modern environmental researcher.

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環境教育に関する生徒の知識，意識，関心に関する調査研究－日本の普通科高校を例として－

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要旨：

持続可能な開発と環境教育は世界的な課題であり，2002年のヨハネスブルク環境サミットでも議題として採り上げられ，特に教育によって持続可能な社会の発展を進めることが合意された。本研究は日本のある高校で1年間にわたって，土を題材とした単元を実施し，その事前事後に環境問題に関する調査を行い，生徒の環境に関する知識，意識，関心についてどのような水準にあり，授業によってどうか変わるかを調査し，明らかにした。

キーワード：環境教育、意識と関心、環境教育カリキュラム
